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ABSTRACT

Whether participation in a school store improved students' performance scores in economic knowledge and mathematics was analyzed. A small grocery store was provided in a classroom to assess the impact of participating in the school store program on the learning and behavior of students in one elementary school in the Jefferson County Public School system. Students received salaries for certain behaviors (i.e., attendance, homework and classwork completion, and appropriate school-related behavior). They were then able to use their earnings to purchase edible and non-edible items in the school store, and thus, applied their mathematical skills. The 43 subjects, in grades 1 to 3 at the study's onset, attended the school the year before the store was established (1984-85), and participated in it for 2 years (1985-86 and 1986-87). Data were assessed for the students as they moved from grades 1, 2, and 3 to grades 3, 4, and 5, respectively. Achievement was measured with the Kentucky Essential Skills Test (KEST), using computation, concepts and applications, and total scores. For the 3 years studied, the school store had little or no positive impact on the students' mathematics achievement, and there were also no clear trends in comparing the mean scores of these students and others in the school district. No evidence was found for a positive impact of the store on the students' mathematics achievement. Three data tables are provided. (SLD)

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Carol David

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Evaluating the Mathematics Scores of Students

Who Participate in a School Store

by Carol David

This paper is part of a dissertation study concerning the impact of participating in a school store program upon the learning and behavior of students in one of Jefferson County Public School's (JCPS) elementary schools. In this particular school, a major supermarket chain supplied a small grocery store in a classroom. As part of this two-year study, student scores in economic knowledge and mathematics were analyzed to determine whether student involvement in a simulation program, such as a school store, improved their performance in these two subject areas. This paper consists of a review of some of the literature pertaining to the effects of simulation programs in elementary schools upon mathematics achievement and a discussion of the methods used to analyze the students' mathematics achievement scores and the results from this study.

Throughout the country, schools have implemented school store programs. At the high school level, school stores are used for distributive education, while at the elementary school level school stores offer students practical opportunities for learning mathematics and basic economics. The following readings concern the uses of school stores for teaching mathematics. One paper of Kapp (1981) is limited to an eighth-grade class, but his suggestions are relevant to other grade levels as well.

School personnel have found that school stores have applications for academic subjects. Kapp (1981) wrote that his eighth-grade students

learned about such geometrical concepts as space and volume by observing the way salt was packaged and stored on the shelf. The students in Kapp's class learned that cylindrical boxes are more efficient for packaging and storing salt. Such practical applications could benefit those students who will study geometry and other higher mathematics later in their academic careers because they will have gained some idea of these mathematical concepts.

Burkett and Whitfield (1985) discussed the ways elementary school students learn mathematics in a classroom supermarket. Such school stores provide opportunities for the students to learn mathematics in a way which is relevant for them. In these school stores, students learn to apply the four basic operations of arithmetic, and they also learn percentages by computing sales tax and ratios and proportions by comparing the prices of varying amounts of food in order to determine what are the best buys.

The research findings of Ortiz and Kourilsky (1985) were also positive regarding the relationship between a simulation program like a school store and higher achievement scores in mathematics. These authors discussed a simulated program which they called "Mini-Society." Ortiz and Kourilsky defined "Mini-Society" as "an economics-oriented/experienced based program in the social studies designed for elementary school pupils" (p. 37). According to these authors, Mini-Society programs gave students realistic rather than vicarious learning experiences. Moreover, the research findings of Ortiz and Kourilsky indicated that teacher in the schools where Mini-Society programs were implemented observed that their students were more interested in

mathematics and that they had higher achievement scores in mathematics. Because the purpose of the Mini-Society program was to teach economics, the teachers did not anticipate higher interest and performance in mathematics.

Ortiz and Kourilsky (1985) completed a correlation study in which they used participation in a Mini-Society program, socio-economic status, receipt of an allowance, sex, and grade level as independent variables in explaining mathematical achievement. According to the results of this correlation analysis, participation in a Mini-Society program explained most (47%) of the variance. Furthermore, these authors state that Mini-Society students showed an advanced level of mathematical reasoning. In conclusion, Ortiz and Kourilsky suggested that this acceleration in mathematical ability in a program designed to promote economic knowledge might be the subject for further research.

The articles by Kapp (1981) and Burkett and Whitfield (1985) described the ways stores have been used in individual classes to teach various mathematical concepts. Only the research study of Ortiz and Kourilsky (1985) involved statistical procedures. However, none of these studies involved a comparison of achievement scores in mathematics over several years as this study attempts to do.

At this particular JCPS elementary school, the school store provides an opportunity for the students to acquire knowledge in an active learning process. The students receive salaries for certain behaviors, such as attendance, homework completion, classwork completion, and appropriate school-related behavior. With their earnings, the students

are able to purchase edible and non-edible items in the school store. Thus they have opportunities to apply their mathematical skills.

Method

As stated by the authors of the papers cited in the literature review, school simulation programs can provide practical learning experiences. Within a school store, students apply their mathematical skills by using the four basic arithmetic operations, by computing percentages in calculating the sales taxes on various items (in Kentucky, non-edible items are subject to the sales tax), and comparing the prices of various weights and volumes. This longitudinal study compares the mathematics achievement scores for 43 students who attended this elementary school during the following school years: 1984-85, the year prior to the opening of the school store; 1985-86, the first year of the store's operation; and 1986-87, the second year of the store's operation.

1984-85 was the first year the Kentucky Essential Skills Test (KEST) was administered. For this study, the normal curve equivalents of the same students for the three school years were used in the analysis. Each student had the following three KEST scores: computation, concepts and applications, and total scores. Table 1 lists the mean scores of these 43 students according to the type of KEST score for the three school years. Table 2 provides the results of repeated measures analysis of variance for the three types of KEST scores to determine whether the school store had any effects upon mathematics achievement. Table 3 is a comparison of these 43 students' means for the three types of KEST scores during the three school years with those for JCPS students at the same grade levels during the same school years. These mean scores are

arranged by grade level during the three school years, i.e. for those going from grades one to three, for those going from grades two to four, and for those going from grades three to five.

Results

Table 1

Mean Scores in Mathematics Achievement on the KEST for the 1984-85, 1985-86 and 1986-87 School Years

N = 43

	Computation	Concepts & Application	Total Scores
1984-85	58.698	63.186	61.605
1985-86	59.256	56.302	57.047
1986-87	59.930	55.791	57.233

Table 2

Results of Within-Subjects Effects

	Source	SS	DF	MS	F	SIG of F
Computation	Within Cells	200085.91	84	239.12		
	Time	32.76	2	16.38	.07	.934
Concepts &	Within Cells	13353.15	84	158.97		
Applications	Time	1466.85	2	733.43	4.61	.013
Total Score	Within Cells	13145.72	84	156.50		
	Time	572.28	2	286.14	1.83	.167

Comparison of Mean Scores on the KEST for the 43 Students and Those for Jefferson County Public School Students

	School with a Store			Jefferson Co. Pub. Schools		
	Comp.	C & A	Total Score	Comp.	C & A	Total Score
1984-85						
Grade One	56.8	66.4	61.9	52.2	60.9	57.4
Grade Two	64.5	54.0	60.3	62.9	64.8	67.0
Grade Three	62.1	61.5	60.5	58.3	61.3	59.8
1985-86						
Grade Two	54.4	54.8	55.6	61.5	62.6	64.9
Grade Three	43.1	51.4	46.1	55.4	58.4	57.0
Grade Four	56.6	46.5	49.8	65.6	60.2	62.1
1986-87						
Grade Three	62.4	63.9	63.9	54.8	58.5	56.6
Grade Four	66.9	61.3	61.5	62.5	59.1	60.1
Grade Five	61.0	53.0	57.9	61.9	61.6	63.9

From the statistical results presented in these three tables, the school store seemed to have little or no positive impact upon the mathematics achievement of these 43 students. Moreover, the results of the repeated measures analysis of variance showed that these 43 students did not make significant gains in their computation and total scores and that their decline in concepts and application scores was significant. This decline may possibly reflect the general decline in reading ability since this section of the KEST consists of word problems.

The next part of analyzing these 43 students' mathematics scores was a comparison of their mean scores with those of other JCPS students at the same grade levels during the same three school years. No clear trend emerged by comparing the means of these 43 students and those of the JCPS students for the three school years. The scores of the students who went from the first-grade to the third-grade in the school with the store did achieve higher means on all parts of the KEST than those of the same grade levels in all other JCPS elementary schools, but these students' mean scores were only slightly higher for the 1986-87 school year than those of the district. According to the results of these statistical analyses, there was no evidence of positive impact upon the mathematics achievement of the 43 students who attended this particular elementary school during the three years under consideration for this study.

Conclusion

As the literature for this study indicates, school stores could potentially offer students practical opportunities in learning mathematics and other subject areas. However, the findings of this study do not support the positive outcomes of higher achievement in mathematics by the students who are involved in school store programs. An explanation for the disparity between the positive effects upon mathematics achievement reported in the literature and the results of this study may be the difficulty in assessing such practical learning with standardized instruments, such as the Kentucky Essential Skills Test.

As schools implement more simulation programs like school stores, attention should be given to the assessment of the learning of various subjects by the students who participate in these programs. Cunningham (1980) discussed the importance of the testing instrument's validity for determining the learning which occurs. To assess any student learning, an instrument must have content validity, the adequacy of an instrument to measure what is learned in a particular program or course, and criterion validity, the capacity of an instrument to measure current or future performance. Both Bennett (1985) and Kourilsky (1983) constructed special instruments to assess the learning of basic economics by students who participate in simulation programs. Effective evaluation of such simulation programs would involve constructing instruments with items which are relevant to the student's learning experiences in the simulation program and/or directly observing student performance, e.g. their ability to buy merchandise with the amount they have to spend, to calculate sales taxes, and to select the best buys by comparing price by weight or volume.

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